National Aeronautics and Space Administration

Keck Interferometer Nuller Status

Mark Colavita, Section 383, and the KI development and operations teams at JPL, MSC/Caltech, and Keck Observatory

Project Objective

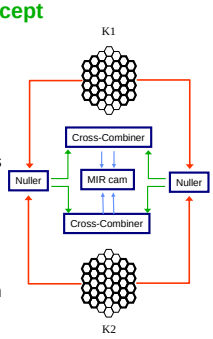
-Combine the two Keck Telescopes as an Interferometer
  -Adaptive Optics (AO) on both telescopes
  -2.2 um active fringe tracking
  -Lots of other active systems
-H & K band fringe visibility mode
  -High sensitivity measurements of a range of astrophysical objects
-10 um nulling mode
  -Measure exozodiacal dust around nearby main sequence stars

Recent Results

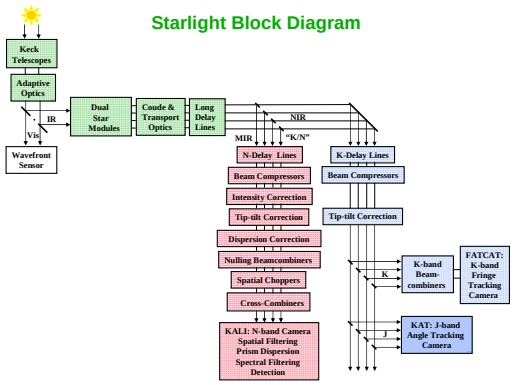
-V2 mode has been routinely available to the community since 2004
-Nuller has recently completed its development & validation, including shared-risk-science observations
-Nuller begins its Key Science program this month
  Key Science team PI's
    Gene Serabyn, JPL
    Phil Hinz, Univ. of Arizona
    Marc Kuchner, GSFC
-First shared-risk nuller science paper on observations of Nova RS Oph just accepted

Nuller Concept

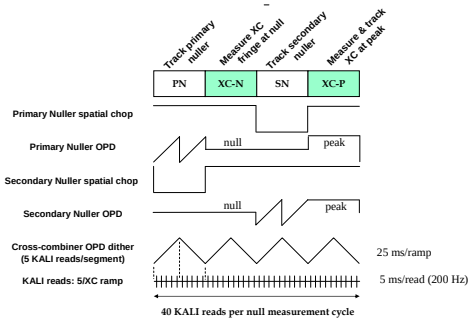
- Two problems
  - Bright star
  - Bright background
- Approach
  - Null star on two 85-m baselines
    - » Improves detectability of surrounding emission
  - Coherently demodulate nulled outputs
    - » Interferometric chopping to measure the nulled signal in the presence of a large background



Starlight Block Diagram



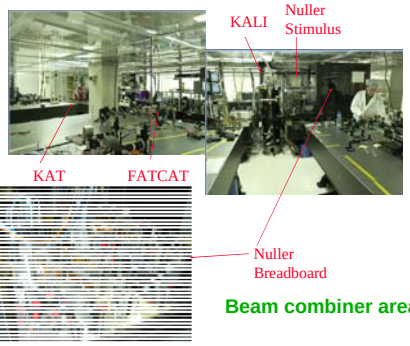
Null measurement sequence



Interferometry basement

See virtual tour at planetquest.jpl.nasa.gov/Keck

Fast delay line area



Beam combiner area

Benefits to NASA and JPL

-Studies of planet-forming regions at K and N band
-Exozodiacal survey of nearby stars to improve on current SED measurements and to support science planning for future exoplanet missions
-Available to the NASA community through the TAC process
-State-of-the art technology for fringe measurement, control, and stabilization at K and N bands

Publications

-R. K. Barry et al. "Milliarcsecond N-Band Observations of the Nova RS Ophiuchi,"2008, ApJ, accepted [arXiv:0801.4165]
-M.M. Colavita, E. Serabyn, P L. Wizinowich, R.L. Akeson, "Nulling at the Keck Interferometer," 2006, SPIE 6268, 626803
-E. Serabyn et al., "The Keck Interferometer Nuller (KIN): configuration, measurement approach,…" 2005, SPIE 5905, 272
For more information, including a list of KI science papers, see http://planetquest.jpl.nasa.gov/Keck
For instrument sensitivities and science support services, see http://msc.caltech.edu/software/KISupport